

We claim:

1. A retractor for manipulating an object, comprising:

a body having proximal and distal ends;

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a retraction device having:

a head connected to said distal end of said body;

10 a connector movably disposed in said body; and

flexible needles of a shape memory material having a memory shape, said needles connected to said connector, said memory shape of said needles including a portion with an arcuate shape; and

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an actuation device connected to said proximal end of said body and operatively connected to said connector through said body, said actuation device, upon actuation thereof, moving said connector to selectively extend said needles out of said head and withdraw said needles into said head.

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2. The retractor according to claim 1, wherein:

said body has a longitudinal extent defining a longitudinal direction; and

said needles extend out of said head in a direction substantially orthogonal to said longitudinal direction.

3. The retractor according to claim 1, wherein said head is connected removably to said 5 distal end of said body.

4. The retractor according to claim 1, wherein said head is integrally formed with said body.

5. The retractor according to claim 1, wherein:

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said head defines tracks for respective ones of said needles; and

said tracks have track exits open to the environment.

15 6. The retractor according to claim 5, wherein said track exits open in a direction at an angle to said longitudinal direction.

7. The retractor according to claim 5, wherein said track exits open in a direction substantially orthogonal to said longitudinal direction.

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8. The retractor according to claim 5, wherein said track exits are disposed to permit movement of said needles therethrough substantially without friction.

9. The retractor according to claim 5, wherein said track exits are disposed on opposing sides 25 of said head and said tracks guide said needles through said track exits.

10. The retractor according to claim 8, wherein at least one surface of said tracks guide said needles in a direction substantially orthogonal to a movement direction of said connector.

5 11. The retractor according to claim 5, wherein:

said needles have a needle diameter; and

said track exits have a diameter at least as large as said needle diameter.

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12. The retractor according to claim 5, wherein said tracks have a shape corresponding to said memory shape of a portion of said needles.

13. The retractor according to claim 12, wherein said memory shape of said needles includes
15 a substantially linear proximal portion and an arcuate distal portion.

14. The retractor according to claim 13, wherein said shape of said tracks corresponds to said memory shape of said proximal portion and to said memory shape of a portion of said distal portion.

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15. The retractor according to claim 5, wherein said head has two head halves clamping said needles therebetween

25 16. The retractor according to claim 15, wherein said two halves are removably connected to one another.

17. The retractor according to claim 15, wherein said head has a shim disposed between said two halves.

5 18. The retractor according to claim 15, wherein said two halves define said tracks.

19. The retractor according to claim 15, wherein said two halves and said shim define said tracks.

10 20. The retractor according to claim 15, wherein:

15 said connector is movably disposed in at least one of said head and said body;

15 said needles each have a proximal portion and a distal portion; and

15 said memory shape of said proximal portion is substantially linear and said memory shape of said distal portion has said arcuate shape.

21. The retractor according to claim 1, wherein said arcuate shape of said portion is no

20 greater than a circle.

22. The retractor according to claim 1, wherein said arcuate shape of said portion is greater than a semi-circle.

25 23. The retractor according to claim 1, wherein said needles are two needles.

24. The retractor according to claim 1, wherein said material is at least one of the group consisting of a pseudo-elastic metal, nitinol, and a Nickel-Titanium alloy.

5 25. The retractor according to claim 1, wherein said actuation device is connected removably to said proximal end of said body.

26. The retractor according to claim 1, wherein:

10 said body has a coil winding and an outer jacket surrounding said coil winding; and

said connector is movably disposed in said coil winding.

27. The retractor according to claim 1, wherein said retraction device grasps the object upon
15 extension of said needles out of said head and releases the object upon withdrawal of said needles into said head.

28. The retractor according to claim 1, wherein:

20 said actuation device has a rod; and

said rod passes through said body and is connected to said connector for moving said connector.

29. The retractor according to claim 28, wherein said rod is integrally formed with said connector.
30. The retractor according to claim 28, wherein said rod is removably connected to said connector.
31. The retractor according to claim 1, further comprising a proximal stop disposed in said body and limiting a retraction range of said needles.
32. The retractor according to claim 1, wherein said actuation device has a locking device selectively retaining said needles in a given position.
33. The retractor according to claim 32, wherein said locking device selectively retains said needles in an extended position.
34. The retractor according to claim 1, wherein said actuation device has an overstroke preventor limiting an extension distance of said needles out of said head.
35. The retractor according to claim 1, wherein said actuation device is a one-handed actuation device.
36. The retractor according to claim 1, wherein said head has an anchoring spike retaining said head at a user-selected placement position.
37. The retractor according to claim 1, wherein said body is a flexible body.

38. The retractor according to claim 1, wherein said body is a rigid body.

39. In combination with a flexible endoscope having at least one working channel, a tissue retractor for manipulating tissue inside a patient, comprising:

a body having proximal and distal ends;

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a retraction device having:

a head connected to said distal end of said body;

10 a connector movably disposed in said body; and

flexible needles of a shape memory material having a memory shape, said needles connected to said connector, said memory shape of said needles including a portion with an arcuate shape; and

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an actuation device connected to said proximal end of said body and operatively connected to said connector through said body, said actuation device, upon actuation thereof, moving said connector to selectively extend said needles out of said head and withdraw said needles into said head;

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wherein said body and said retraction device are sized to fit within the working channel of the endoscope.

40. The retractor according to claim 39, wherein said needles are sized to selectively grasp

25 alimentary tract tissue.

41. The retractor according to claim 39, wherein said needles are sized to extend into mucosa without extending into muscularis.

5 42. The retractor according to claim 39, wherein said needles are sized to extend through mucosa and into muscularis.

43. The retractor according to claim 39, wherein said needles are sized to extend into mucosa and muscularis without extending into serosa.

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44. The retractor according to claim 39, wherein said needles are sized to selectively extend through different layers in the gastric wall.

45. The retractor according to claim 39, wherein:

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said head defines openings on opposing sides thereof; and

said memory shape of said needles curves said needles away from opposing sides of said connector.

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46. The retractor according to claim 39, wherein:

said body has a longitudinal extent defining a longitudinal direction; and

1 said needles extend out of said head in a direction substantially orthogonal to said
2 longitudinal direction.

47. The retractor according to claim 39, wherein said head is connected removably to said
5 distal end of said body.

48. The retractor according to claim 39, wherein said head is integrally formed with said
body.

10 49. The retractor according to claim 39, wherein:

15 said head defines tracks for respective ones of said needles; and

20 said tracks have track exits open to the environment.

25 50. The retractor according to claim 49, wherein said track exits open in a direction at an
angle to said longitudinal direction.

51. The retractor according to claim 49, wherein:

20 said memory shape of said needles includes a substantially linear proximal portion and an
arcuate distal portion; and

25 said tracks have a shape corresponding to said memory shape of said proximal portion and to
said memory shape of a portion of said distal portion.

52. The retractor according to claim 39, wherein said arcuate shape of said portion is no greater than a circle.

5 53. The retractor according to claim 39, wherein said needles are two needles.

54. The retractor according to claim 39, wherein said material is at least one of the group consisting of a pseudo-elastic metal, nitinol, and a Nickel-Titanium alloy.

10 55. The retractor according to claim 1, wherein:

said actuation device has a rod; and

said rod passes through said body and is connected to said connector for moving said

15 connector.

56. The retractor according to claim 55, wherein said rod is integrally formed with said connector.

20 57. The retractor according to claim 55, wherein said rod is removably connected to said connector.

58. The retractor according to claim 39, wherein said actuation device is a one-handed actuation device.

59. The retractor according to claim 39, wherein said head has an anchoring spike retaining said head at a user-selected placement position.

60. The retractor according to claim 39, wherein said body is a flexible body.

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61. The retractor according to claim 39, wherein said body is a rigid body.

62. The retractor according to claim 39, further comprising a proximal stop disposed in said body and limiting a retraction range of said needles.

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63. The retractor according to claim 39, wherein said actuation device has a locking device selectively retaining said needles in a given position.

64. The retractor according to claim 63, wherein said locking device selectively retains said needles in an extended position.

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65. The retractor according to claim 39, wherein said actuation device has an overstroke preventor limiting an extension distance of said needles out of said head.

66. A tissue retractor, comprising:

a body having proximal and distal ends;

5 a retraction device having:

a head connected to said distal end of said body and defining two opposing openings;

a connector movably disposed in said body; and

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flexible needles of a shape memory material having a memory shape, said needles connected to said connector, said memory shape of said needles including a portion with an arcuate shape; and

15 a one-handed actuation device connected to said proximal end of said body and operatively connected to said connector through said body, said actuation device, upon actuation thereof, moving said connector to selectively extend said needles out of said head and withdraw said needles into said head.

67. A method for retracting tissue, which comprises:

positioning a flexible endoscope having at least one working channel adjacent a location of tissue to be retracted;

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passing the tissue retractor according to claim 1 through the working channel of the endoscope;

positioning the head of the retractor at a desired retraction location on the tissue;

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actuating the actuation device to extend the needles into the tissue at the desired retraction location; and

retracting the tissue with the retractor.

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68. The method according to claim 67, which further comprises actuating the actuation device to retract the needles back into the head to release the tissue.

69. A method for retracting tissue, which comprises:

positioning the endoscope according to claim 39 adjacent a location of tissue to be retracted;

5 passing the tissue retractor through the working channel of the endoscope;

positioning the head of the retractor at a desired retraction location on the tissue;

actuating the actuation device to extend the needles into the tissue at the desired retraction

10 location; and

retracting the tissue with the retractor.

70. The method according to claim 69, which further comprises actuating the actuation

15 device to retract the needles back into the head to release the tissue.

71. A method for retracting tissue for the treatment of Gastroesophageal Reflux Disease, which comprises:

positioning a flexible endoscope having at least one working channel adjacent a desired

5 retraction location of the wall of the stomach;

passing the tissue retractor according to claim 1 through the working channel of the

endoscope;

10 positioning the head of the retractor on the desired retraction location of the stomach wall;

actuating the actuation device to extend the needles into the stomach wall at the desired
retraction location; and

15 retracting the stomach wall with the retractor.

72. The method according to claim 71, which further comprises shaping a curvature of the needles to limit penetration of the stomach wall to a depth no greater than the muscularis.

20 73. The method according to claim 71, which further comprises:

providing a clip implantation and plication instrument having a proximal actuating handle and a distal end effector with jaws, the jaws containing male and female parts of a plication fastener;

positioning the end effector adjacent the retracted stomach wall;

operating the proximal actuating handle to cause the jaws of the end effector to open;

5 pulling the retracted stomach wall between the opened jaws of the end effector;

operating the actuation handle to cause the jaws to close about the retracted stomach wall while holding a substantially central point of the stomach wall between the jaws with the retractor and form a tissue plication with the jaws as the male and female parts of the fastener

10 are brought together with the plication clamped therebetween;

when the jaws are closed about the plication, deploying the fastener to pierce the plication with the male part of the fastener through the serosal layers of the plication forming a serosa-to-serosa contact on the inside surfaces of the plication;

15 determining the location and size of the plication and relative position of the fastener parts with the endoscope and:

if a satisfactory implantation is determined, operating the proximal actuation handle to

20 lock the male and female parts of the fastener and to release the locked fastener from the jaws; and

if a satisfactory implantation is not determined, re-opening and re-orienting the jaws to form another plication until a satisfactory implantation is determined and, then,

operating the proximal actuation handle to lock the male and female parts of the fastener and release the locked fastener from the jaws;

opening the jaws; and

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withdrawing the clip implantation and plication instrument and the endoscope through the esophagus and out of the patient.

74. The method according to claim 73, which further comprises:

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approaching the retracted stomach wall with the jaws in a direction substantially parallel to the esophagus; and

forming the plication substantially parallel to the esophagus.

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75. A method for retracting tissue for the treatment of Gastroesophageal Reflux Disease, which comprises:

5 positioning the endoscope according to claim 39 adjacent a desired retraction location of the stomach wall of the stomach;

passing the tissue retractor through the working channel of the endoscope;

10 positioning the head of the retractor on the desired retraction location of the stomach wall;

15 actuating the actuation device to extend the needles into the stomach wall at the desired retraction location; and

retracting the stomach wall with the retractor.

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76. The method according to claim 75, which further comprises shaping a curvature of the needles to limit penetration of the stomach wall to a depth no greater than the muscularis.

25 77. The method according to claim 75, which further comprises:

20 providing a clip implantation and plication instrument having a proximal actuating handle and a distal end effector with jaws, the jaws containing male and female parts of a plication fastener;

25 25 positioning the end effector adjacent the retracted stomach wall;

operating the proximal actuating handle to cause the jaws of the end effector to open;

pulling the retracted stomach wall between the opened jaws of the end effector;

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operating the actuation handle to cause the jaws to close about the retracted stomach wall while holding a substantially central point of the stomach wall between the jaws with the retractor and form a tissue plication with the jaws as the male and female parts of the fastener are brought together with the plication clamped therebetween;

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when the jaws are closed about the plication, deploying the fastener to pierce the plication with the male part of the fastener through the serosal layers of the plication forming a serosa-to-serosa contact on the inside surfaces of the plication;

15 determining the location and size of the plication and relative position of the fastener parts with the endoscope and:

if a satisfactory implantation is determined, operating the proximal actuation handle to lock the male and female parts of the fastener and to release the locked fastener from the jaws; and

if a satisfactory implantation is not determined, re-opening and re-orienting the jaws to form another plication until a satisfactory implantation is determined and, then, operating the proximal actuation handle to lock the male and female parts of the fastener and release the locked fastener from the jaws;

opening the jaws; and

5 withdrawing the clip implantation and plication instrument and the endoscope through the esophagus and out of the patient.

78. The method according to claim 77, which further comprises:

10 approaching the retracted stomach wall with the jaws in a direction substantially parallel to the esophagus; and

forming the plication substantially parallel to the esophagus.

79. The method according to claim 67, which further comprises:

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providing the retractor with a removable handle; and

removing the handle after the needles are extended into the tissue.

20 80. The method according to claim 79, which further comprises guiding a second endoscope over the body of the retractor towards the head of the retractor.

81. The method according to claim 69, which further comprises:

25 providing the retractor with a removable handle;

removing the handle after the needles are extended into the tissue; and

guiding a second endoscope over the body of the retractor towards the head of the retractor.

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82. A method for grasping an object, which comprises:

positioning the head of the retractor according to claim 1, at a desired location on the object;

5 actuating the actuation device to extend the needles into the object at the desired location to
grasp the object with the retractor.

83. The retractor according to claim 1, wherein said actuation device, upon actuation thereof,
moves said actuator to selectively extend said needles out of said head into tissue of a patient
10 and withdraw said needles from the tissue into said head.

84. The retractor according to claim 1, wherein said needles are sized to control penetration
depth through tissue.

15 85. The retractor according to claim 1, wherein said needles are fixedly connected to said
connector.

86. The retractor according to claim 39, wherein said needles are fixedly connected to said
connector.

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87. The retractor according to claim 66, wherein said needles are fixedly connected to said
connector.